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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 09/974,814 | 10/12/2001 | Masashi Sahara | 501.40724X00 | 8257 |
| 20457 | 7590 | 05/05/2004 | EXAMINER | |
| ANTONELLI, TERRY, STOUT & KRAUS, LLP 1300 NORTH SEVENTEENTH STREET SUITE 1800 ARLINGTON, VA 22209-9889 | | | QUACH, TUAN N | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2814 | |

DATE MAILED: 05/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/974,814

Applicant(s)

SAHARA ET AL.

Examiner

Tuan Quach

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-- The MAILING DATE of this communication appears on the cover sheet with the corresponding address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 February 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) See Continuation Sheet is/are pending in the application.
- 4a) Of the above claim(s) 1,3-8,10-15,17-22,24-29,31-36,38-43,45-50,52-57,59-64,66-102 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 103 and 105-112 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 October 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
 - 2) ☐ Certified copies of the priority documents have been received in Application No. _____.
 - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

Continuation of Disposition of Claims: Claims pending in the application are 1,3-8,10-15,17-22,24-29,31-36,38-43,45-50,52-57,59-64,66-103 and 105-112.

DETAILED ACTION

Claims 103 and 105-112 are elected without traverse.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 103, 105-109, 111-112 are rejected under 35 U.S.C. 102(b) as being anticipated by EP 325 328.

Re claim 103, 107-111, '328 teaches forming semiconductor integrated device comprising forming gate insulating film on semiconductor substrate 1, forming conductive film gate 6, 7, forming self-aligned lightly doped semiconductor regions 12,13, forming second insulating 14 on side surface of conductive film 6, 7, forming second semiconductor regions 10 and 11 of source/drain regions higher concentration, HF cleaning, argon sputter etching of less than 20 nm (thus encompassing less than 2.5 nm), forming silicides 6a-11a, including cobalt silicide. See column 6 line 1 to column 7 line 49, column 14 line 40.

Re claim 105, the silicide contacts made to source/drain regions and not to LDD regions are shown in Figs. 1-5 wherein the silicide contacts are made self-aligned to the source/drain regions exposed through the spacers 14.

Re claim 106, the silicide contacts are made to source drain regions exposed by the spacers (and not to regions under the spacers) as shown above, the leakage current improvement would be obtained as the sputter etching including the ultrashallow range as taught.

Re claim 107, the sputter etching carried out after the cleaning using hydrofluoric acid is taught by '328 above, column 6 line 58.

Claim 110 is rejected under 35 U.S.C. 103(a) as being unpatentable over '328 in view of Zeininger.

Re claim 110, the selection and optimization of cobalt silicide between 20 and 400 angstroms in '328 would have been obvious to one skilled in the art and as evidenced by Zeininger, column 3 line 10.

Claims 103 and 105-112 are rejected under 35 U.S.C. 103(a) as being unpatentable over '328, Kamal, and Zeininger taken together.

'328 is applied as above. Regarding the range of 2.5 nm or less, in addition to the reason above, such would have been obvious for the reasons below. Kamal teaches the self-aligned silicidation for MOS transistor including argon sputter etch of silicon surface prior to cobalt silicidation. The process includes forming MOS components including gate oxide 104, gate 110, source/drain 106/108 (note in Fig. 10 wherein the shape of the device 208 evidencing the first and second regions although

the details of such first and second doped regions are not delineated in Kamal in the manner taught in '328 supra). Kamal shows the extent of the etching including the selection of removal of 20 angstrom, column 5 line 65. The advantage of silicide contacts upon such sputter cleaning including self-aligned contacts having improved device characteristics. See column 2 line 48 to column 7 line 48.

Zeininger teaches the formation of cobalt silicide contacts to device regions of deep sub-micron including sputter etching between 3 and 20 mono layer to remove native oxide, wherein an ultrashallow damage region would be achieved prior to forming cobalt silicide contacts. Appropriate cobalt silicide thickness such as 300 nm or less is also shown. See column 2 line 25 to column 3 line 38.

It would have been obvious to one skilled in the art in practicing '328 process to have employed the shallow removal range of the sputter etching, including within the range of 25 nm or less since such corresponds to a conventional removal range as evidenced by a low target removal range such as 20 angstrom as shown in Kamal, thus less than 2.5 nm, and as evidenced by Zeininger, wherein the removal of as low as a few monolayers (between 3 and 20 monolayers) can be effected to effect the ultrashallow region prior to formation of silicide contacts to improve device characteristics. Regarding claim 105, the silicide contacts to the second regions and not to the first regions would have been apparent in '328 for the reasons delineated above, and as Kamal show the exposed region for contact to the second regions and not the first region which is blocked by the spacers, e.g., Fig. 10. Regarding claim 110,

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the selection and optimization of suitable layer thickness would have been obvious and conventional as evidenced by Zeininger as delineated above.

Applicant's arguments with respect to claims 11, 3-8, 10-15, 17-22, 24-29, 31-36, 38-43, 45-50, 52-57, 59, 64, 66-103, 105-112 have been considered but are moot in view of the new ground(s) of rejection.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Quach whose telephone number (571)272-1717. The examiner can normally be reached on M - F from 7 to 4.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor Wael Fahmy can be reached on (571)272-1705. The fax phone number for the organization where this application or proceeding is assigned is (703)872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571)272-1562.

A handwritten signature in black ink, appearing to read "Quach", with a stylized flourish at the end.

Tuan Quach
Primary Examiner